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XH3R – USER'S MANUAL

SELF-CONTAINED, SINGLE PUMP WELLHEAD CONTROL PANEL

GENERAL

The XH3R self-contained hydraulic alarm and shutdown panel is a device designed and built for protecting oil and gas production wells. It includes a switch-gage to detect high and low pressures as well as hydraulic interface for fire shutdown and manual ESD (**E**mergency **S**hut **D**own). It is self-sufficient and doesn't need external sources of energy or supply pressure for keeping a wellhead open and protected. It includes a hand pump and dump valve for controlling the SSV.

The detection of High and Low pressures is done by a switch-gage with adjustable contacts for detecting high and low pressure alarms on the flow line. The switch-gage connects to an electronic module that indicates High and Low pressure conditions as well as initiates the shutdown when an alarm is detected. The electronic circuits are fed by a battery module capable of keeping the system operating for five (5) years.

The XH3R is built to operate exposed to the elements as all hydraulic components are enclosed in a stainless steel box while the electronic circuits and battery module are enclosed in an explosion proof box inside the stainless steel box. The front of the panel includes the gages and controls as shown in Fig. 1. The inside components are shown in Fig. 2.

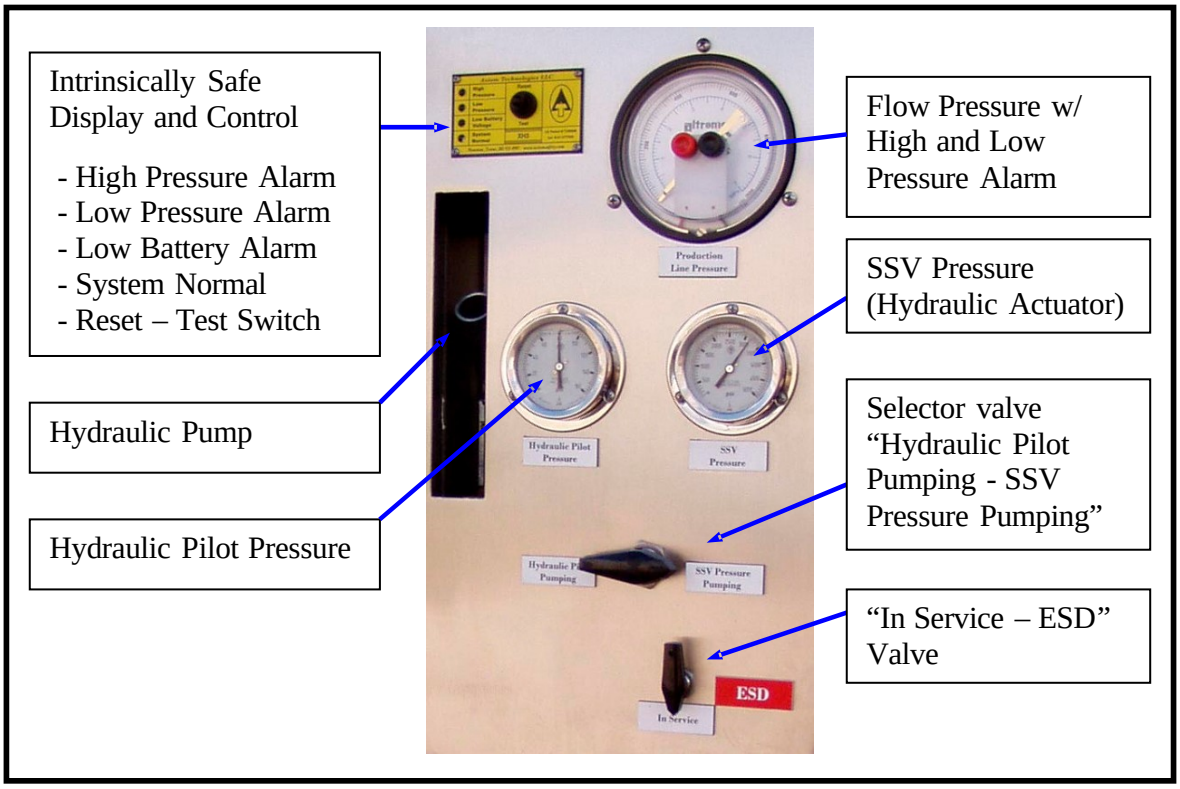

Fig. 1 XH3R Interfase y controles.

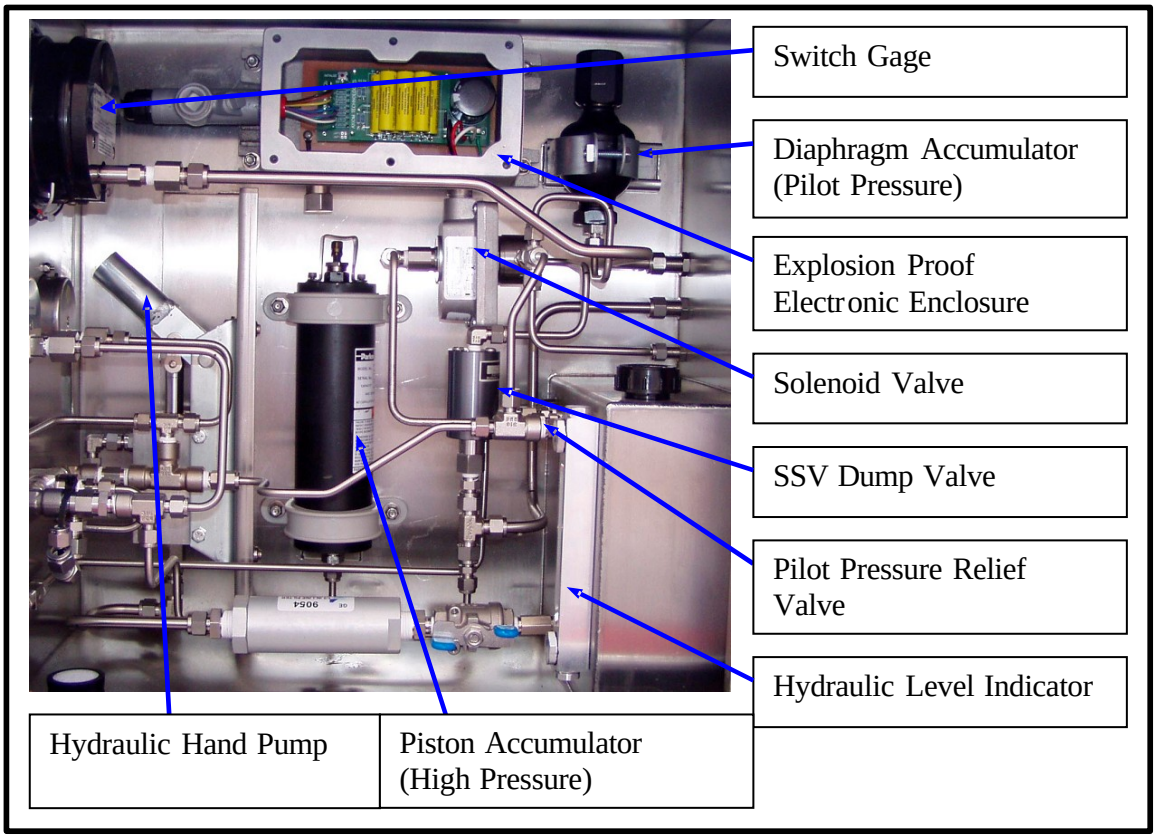

Fig. 2 – XH3R Enclosure's Interior

INSTALLATION – PRELIMINARY STEPS AND TESTS

The XH3R is shipped with the battery module mounted backwards to prevent the device from operating while in transit. Also, as needed to meet shipping regulations, it is typically shipped without hydraulic fluid in the reservoir and without Nitrogen pre-charge in the accumulators.

Before installing the XH3R is to be inspected to confirm that there is no external damage or indication of rough handling during shipment.

In case of overseas shipments it is recommended that the XH3R is tested in a work shop near the final destination to facilitate the commissioning and allow the operators to become familiar with the unit.

NOTE

It is recommended that the operator becomes familiar with the Hydraulic Schematic (Appendix "B") and have a copy handy during the tests described below to better understand the system's behavior.

To commission the system follow with the steps listed below:

i. Pre-charge the 15 CU IN piston accumulator with 1,000 psi of Nitrogen.
ii. Pre-charge the 5 CU IN diaphragm accumulator with 45 psi of Nitrogen.
iii. If the reservoir is empty, add approximately one and a quarter gallon hydraulic fluid to the reservoir. Filling is to be done with care not to exceed the "High" level mark in the liquid gauge.
iv. After confirming the environment does not contain ignitable mixture of gases, open Explosion Proof Box mounted inside the stainless steel box, remove battery module and re-install after rotating 180º as indicated in Appendix "A". By doing this the electronic circuit becomes energized and the green LED "System Normal" blinks every two seconds (heartbeat) to indicate the electronic circuit is operating without problem.
v. Before applying pressure to any of the circuits it is recommended that hydraulic fluid is circulated throughout the system to flush any particle material and contaminants that could be present within the hydraulic lines. With this purpose proceed as follows:

    a) Set valve "In Service – ESD" to "ESD".
    b) Set selector valve "Hydraulic Pilot Pumping - SSV Pressure Pumping" to "Hydraulic Pilot Pumping"
    c) Operate pump in a fast mode for approximately one minute while observing the "Hydraulic Pilot Pressure" gage. This gauge should display "0" psi but the needle oscillates with each pump strike.
    d) Set selector valve "Hydraulic Pilot Pumping - SSV Pressure Pumping" to "SSV Pressure Pumping"
    e) Again, operate pump in a fast mode for approximately one minute while observing the "SSV Pressure" gauge. This gauge should stay in "0" psi

vi. Confirm that the plugs on the bulkhead connectors are tight before proceeding with the following steps.
vii. Set valve "In Service – ESD" to "In Service".
viii. Set selector valve "Hydraulic Pilot Pumping - SSV Pressure Pumping" to "Hydraulic Pilot Pumping"
ix. Press "Reset" (up) for about one second on switch "Test – Reset".
x. Operate pump while observing the "Hydraulic Pilot Pressure" gauge and until reaching 80 psi. Inspect hydraulic lines and confirm that there is no leakage.
xi. Set selector valve "Hydraulic Pilot Pumping - SSV Pressure Pumping" into "SSV Pressure Pumping"
xii. Operate pump while observing the "SSV Pressure" gauge and until reaching 3,000 psi. Inspect hydraulic lines to confirm that there is no leakage. It is normal for the pressure to fall about 10% after finishing the pumping. (The pressure falling is due to the cooling of the Nitrogen that had warmed up as consequence of the pressure increase when pumping)
xiii. Set valve "In Service – ESD" to "ESD" to return all pressures to cero before moving the XH3R to the field for installation.

FIELD INSTALLATION

Typically the XH3R is mounted on one or two poles made of 2 or 3" pipe. Using two poles is preferred because is a simple method and insures safe mounting even if one of the four pipe brackets used for fastening the panel to the poles would fail. The two poles should have a separation of 10" to 14" (25 to 35cm) center to center. The pipe brackets attach to the unistrut channels mounted on the left side of the panel

With the panel firmly mounted, proceed to connect the field devices to the rear of the panel as shown on the figure below.

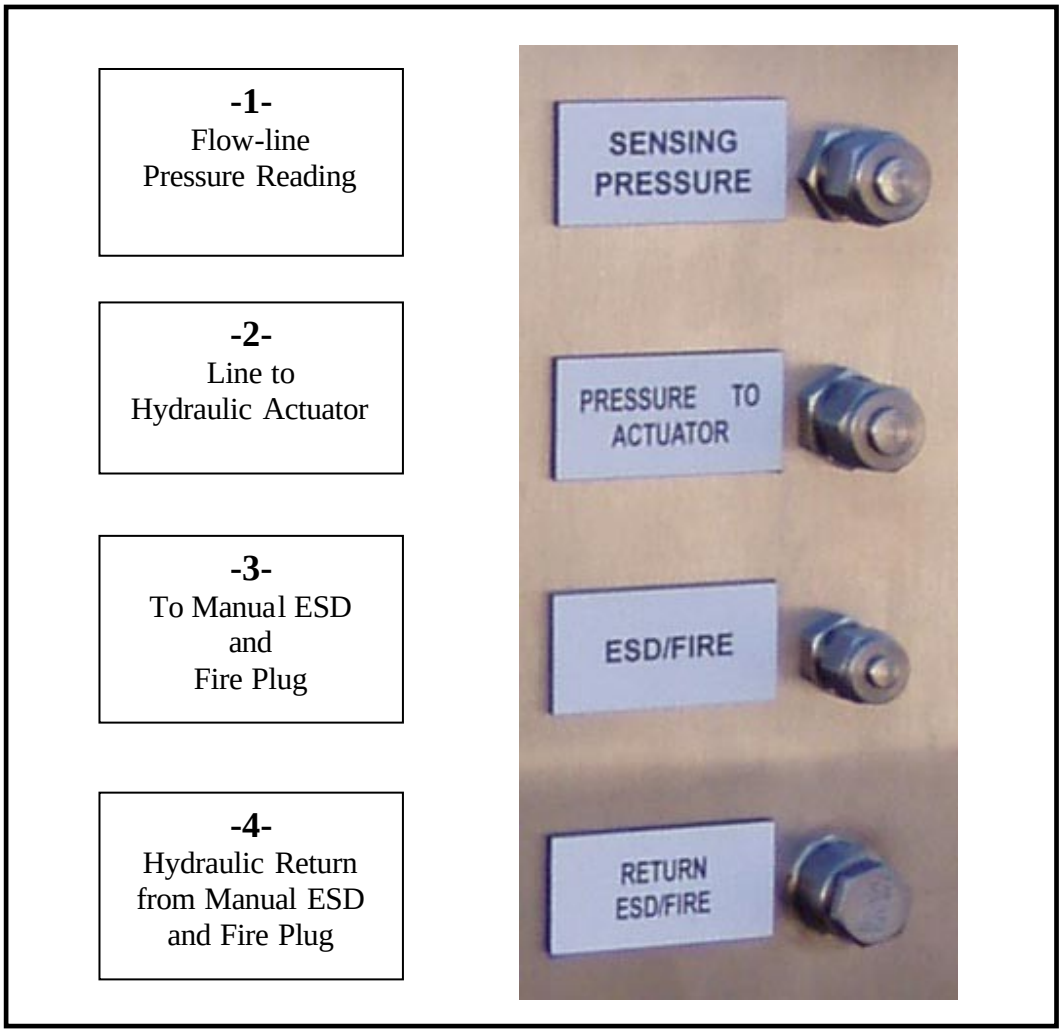

Fig. 3 – XH3R, rear view, field connections

The connection to the manual ESD station can also connect to a fire plug. If the fire plug does not have a return line, some means are to be used to prevent hydraulic fluid from reaching the ground. A small amount of hydraulic fluid (approximately 3 CU IN or 50 CC) will be released in the event of the fire plug responding to a fire.

OPERATION AND ADJUSTMENTS

The operation of the installed panel is as follows:

Starting Production:

1- Set valve "In Service – ESD" to "In Service"
2- Set selector valve "Hydraulic Pilot Pumping - SSV Pressure Pumping" to "Hydraulic Pilot Pumping".
3- Press "Reset" for about one second on switch "Test – Reset".
4- Operate pump while observing the "Hydraulic Pilot Pressure" gauge until reaching 80 psi.
5- Set selector valve "Hydraulic Pilot Pumping - SSV Pressure Pumping" into "SSV Pressure Pumping".
6- Operate pump while observing the "SSV Pressure" gauge and until reaching 2,000 psi. It is normal for the pressure to fall about 10% after finishing the pumping. Do not exceed maximum actuator's pressure.
7- Check all hydraulic connections (internal and external to the panel) to confirm that there is no leakage.
8- Adjust High and Low Alarm set point on switch-gage.

Closing SSV:

9- Turn "In Service – ESD" valve to "ESD".

Re-opening the SSV:

10- If any of the red LEDs is flashing Press "Reset". The Alarm LED stops blinking while the green LED "System Normal" blinks every two seconds.
11- If "In Service – ESD" valve is on "ESD" turn it to "In Service"
12- Set selector valve "Hydraulic Pilot Pumping - SSV Pressure Pumping" to "Hydraulic Pilot Pumping".
13- Pump while observing the "Hydraulic Pilot Pressure" gauge until reaching 80 psi.
14- Set selector valve "Hydraulic Pilot Pumping - SSV Pressure Pumping" into "SSV Pressure Pumping".
15- Operate pump while observing the "SSV Pressure" gauge and until reaching 2,000 psi. It is normal for the pressure to fall about 10% after finishing the pumping. Do not exceed maximum actuator's pressure.

Adjusting High and Low Pressure Alarms:

16- Turn right side knob to adjust High pressure Alarm to the desired High Pressure Alarm. Repeat the same with the left side knob to set the Low Pressure Alarm.

HYDRAULIC SCHEMATICS

The hydraulic circuits are shown on appendix "B".

ELECTRONIC SYSTEM

By replacing most of the traditional hydraulic logic with electronic circuits, the most failure prone components are no longer needed and the hydraulic circuit greatly simplified to a few reliable components. By having self diagnostic in the electronics and

a simplified hydraulic system, the XH3R offers a reliability level not seen on any of the typical self-contained wellhead control panel. Furthermore, if a failure would occur, the diagnostic and correction of the problem is much easier because of the simplicity of the hydraulics.

The electronic circuit and battery module are enclosed in an explosion proof box that makes the system suitable for Class 1 Div.1 hazardous areas, where ignitable mixtures of combustible gases may exist.

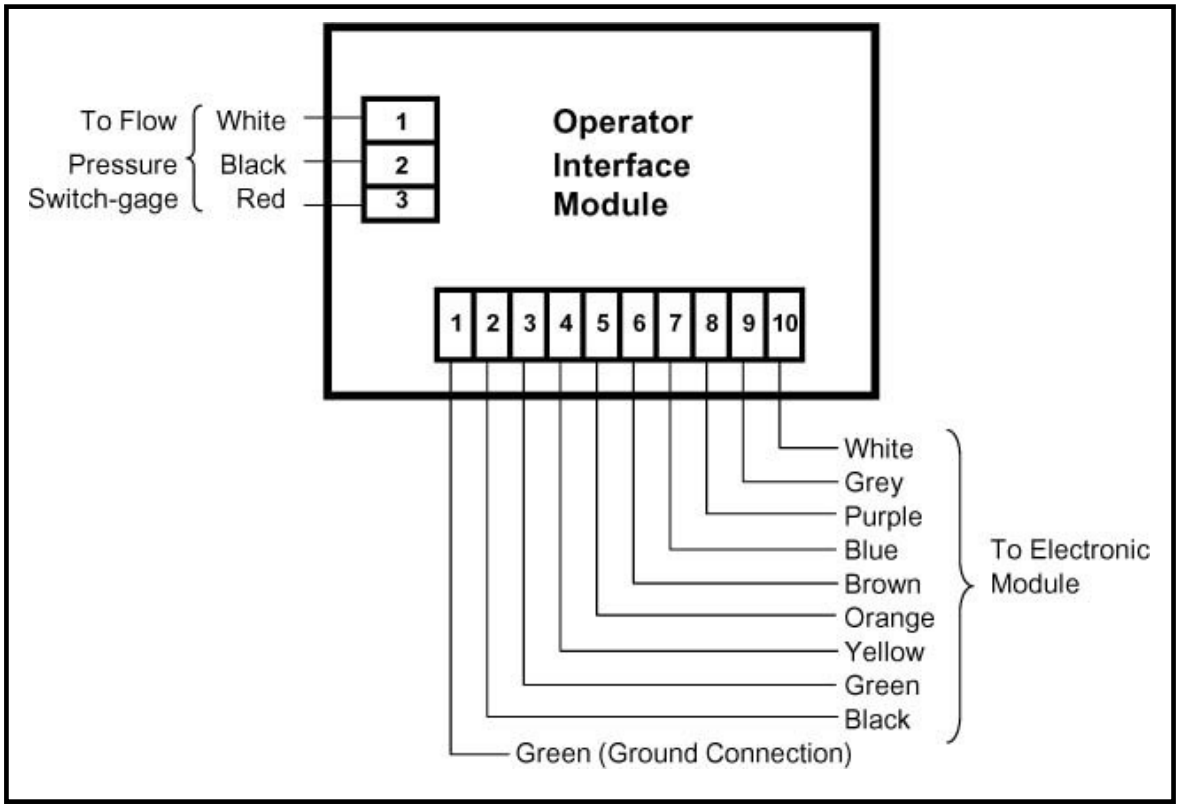

Fig. 4 – Wiring to the intrinsically safe interface module

The wiring from the Pressure Switch-Gage to the Interface Module as well as the wiring from the Interface Module to the Electronic Module is color coded as shown in Fig. 4

The interface module includes the indicator LEDs, the "Test –Reset" switch. The circuits connecting to the Interface Module use energy level so low that they are incapable of igniting the type of combustible mixtures found in the oil industry and the circuits exposed to such environment have been designed to meet the "Intrinsically Safe" criteria.

When operating under normal conditions (no alarms) the electronic system flashes the green LED "System Normal" every two seconds to indicate that the electronic system is operating without problems.

If a High Pressure or Low Pressure alarm is detected the solenoid valve is tripped to initiate shutdown, the green LED stops flashing and the red LED corresponding to the detected alarm starts flashing. Once detected, the first alarm is latched in such way that even if it would go away or a new alarm was detected; the first alarm continues flashing, holding the information for the operator to see the true cause of the shutdown. For example, if a High Pressure Alarm would occur the corresponding "High Pressure" alarm LED will flash and keep on flashing even if the high pressure would go away and now the needle touches the "Low Pressure" alarm contact. The first alarm remains flashing until the operator presses "Reset"

When the operator presses "Reset" (for about one second) the system ignores the existing pressure alarm and resets the solenoid valve to allow the re-opening of the well. In this case the green LED flashes even if the alarm still present. However, the system tolerates the existing alarm for only 30 minutes before re-initiating the alarm and shutdown.

The "Test" function allows the operator to see the last alarm condition and also to confirm that all the indicator LEDs are working properly. When pressing "Test", the system respond by flashing the last detected alarm for about two seconds and then it flashes the three red LEDs in sequence.

The battery module provides two separate voltages, 3.6 VDC to feed the microcontroller circuits and 14.4 VDC to operate the solenoid valve. Both voltages are periodically monitored to confirm the system has the proper battery supply to operate reliably.

If any of the voltages goes down to a level that is below normal but still offers sufficient energy for reliable operation, then the "Low Battery Voltage" Red LED and green LED "System Normal" blink alternatively to indicate the need to replace the batteries soon.

If any of the voltages falls to the point where it may affect the reliability of the operation then the system will initiate shutdown and only the "Low Battery Voltage" Red LED blinks.

Given the low power consumption of the system it is expected the operator will be alerted by the warning "Low Battery Voltage" condition with ample time for replacing the battery module long before it gets to the point where the system may cause shutdown on "Low Battery Voltage" alarm.

The battery module is to be replaced as soon as the system starts flashing the "Low Battery Voltage" alarm red LED to insure the system keeps on operating reliably. The battery module has an expected life of five years

See the instructions shown on Appendix "A" for replacing the battery module.

WARNING!

Do not attempt to recharge the batteries on the battery module as this may cause an instable condition that may result in a violent explosion.

Return the spent battery modules to Axiom Technologies or to any lithium battery recycling facility.

CAUTION! - TO REDUCE THE RISK OF IGNITION OF HAZARDOUS ATMOSPHERES:

- **Do not open explosion proof enclosure unless the area is known free of ignitable mixture of gases. Keep tightly closed when in operation.**
- **Substitution of components may impair Intrinsic Safety.**
- **Battery Module is to be replaced only with Axiom Part No. AT-LBP-36144 battery module.**

XH3R - ENVIRONMENTAL SPECIFICATIONS

Temperature range	:	-25 to +40ºC
Humidity range	:	0 To 95% max., non condensing
Altitude	:	2,000 m. max.
Hazardous Area Classification	:	Suitable for Class I, Division 1, Groups C & D, Hazardous Locations. Temp. Code T3C

XH3R - PRESSURE RATINGS

Sensing Pressure	:	Ranges of up to 20,000 psi max
Solenoid Valve Pressure	:	100 psi max.

XH3R - ELECTRICAL RATINGS

Electrical Source	:	Dual voltage lithium battery module3.6 & 14.4 VDC.
Power	:	0.2 mW Continuous, 45 W Pulse Max.